The Metric System and Dimensional Analysis

THESE PREFIXES MAY BE APPLIED TO ALL SI UNITS

Multiples and Submultiples	Prefixes	Symbols
1 000 000 000 000 = 10^{12}	tera (tĕr 'ə)	T
1 000 000 000 = 10^{9}	giga (jĭ 'gə)	G
1 000 000 = 10^{6}	mega (mĕg 'ə)	M*
1 000 = 10^{3}	kilo (kĭl 'ō)	k*
100 = 10^{2}	hecto (hĕk 'tō)	h
10 = 10	deka (dĕk 'ə)	da
0.1 = 10^{-1}	deci (dĕs 'ĭ)	d
0.01 = 10^{-2}	centi (sĕn 'tĭ)	c*
0.001 = 10^{-3}	milli (mĭl 'ĭ)	m*
0.000 001 = 10^{-6}	micro (mī 'krō)	μ*
0.000 000 001 = 10^{-9}	nano (năn 'ō)	n
0.000 000 000 001 = 10^{-12}	pico (pē 'kō)	p
0.000 000 000 000 001 = 10^{-15}	femto (fĕm 'tō)	f
0.000 000 000 000 000 001 = 10^{-18}	atto (ăt 'tō)	a

*Most commonly used

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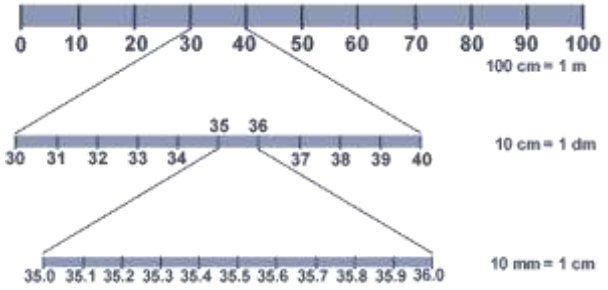
Prefix	*Symbol*	*Value*	*Factor*
kilo-	**k**	**1000**	**10^3**
hecta-	h	100	10^2
decca-	da	10	10^1
Base	**m, g, l**	**1**	**10^0**
deci-	**d**	**1/10 or 0.1**	**10^{-1}**
centi-	**c**	**1/100 or 0.01**	**10^{-2}**
milli-	**m**	**1/1000 or 0.001**	**10^{-3}**

Base units:
Length: meter (m)
Mass: grams (g)
Volume: liters (L)



$1ml = 1cm^3$ **$1L = 1dm^3$**

Converting with in the metric system using Dimensional Analysis

1. Begin with the **KNOWN QUANTITY**. Place all the known quantity in the numerator of the beginning fraction if there is no denominator.

Ex. How many cm are in 42.45km?

$$\frac{42.45\text{km}}{1}$$

2. Determine the possible conversion factors, in other words how are the units related?

$$\frac{10\,000\text{cm}}{1\text{km}} \quad \text{or} \quad \frac{1\text{km}}{10\,000\text{cm}}$$

3. Use the conversion factor that will allow you to cancel out the unit you started with

$$\frac{42.45\text{km}}{1} \times \frac{10\,000\text{cm}}{1\text{km}}$$

4. Carry out the operation by first canceling out units, and check to make sure the unit we want is the only one left.

$$\frac{42.45\cancel{\text{km}}}{1} \times \frac{10\,000\text{cm}}{1\cancel{\text{km}}} =$$

5. Now carry out the math following order of operations.

$$\frac{42.45\cancel{\text{km}}}{1} \times \frac{10\,000\text{cm}}{1\cancel{\text{km}}} = 424\,500\text{cm}$$

A Harder One:

What is the density of mercury (13.6 g/cm^3) in units of kg/m^3, density = mass/volume

$$?\ D\left(\frac{\text{kg}}{\text{m}^3}\right) = \frac{13.6\ \text{g}}{1\ \text{cm}^3} \times \frac{(100\ \text{cm})^3}{(1\ \text{m})^3} \times \frac{1\ \text{kg}}{1000\ \text{g}}$$

$$= \frac{13.6\ \cancel{\text{g}}}{1\ \cancel{\text{cm}^3}} \times \frac{1 \times 10^6\ \cancel{\text{cm}^3}}{1\ \text{m}^3} \times \frac{1\ \text{kg}}{1000\ \cancel{\text{g}}}$$

$$= 1.36 \times 10^4\ \text{kg/m}^3$$